

# AGE NO<sub>x</sub> Emission Reduction

The US Air Force Research Laboratory (AFRL/MLQ) Reduces Aerospace Ground Equipment NO<sub>x</sub> Emission

## THE PROBLEM:

March Air Force Base (AFB), California, is located in the heart of the nation's non-attainment area for ozone. The South Coast Air Quality Management District (SCAQMD) is the local regulatory agency responsible for promulgating and enforcing regulations to meet the National Ambient Air Quality Standard (NAAQS) for ozone. Since NO<sub>x</sub> is considered a precursor to ozone, many of the SCAQMD rules are aimed at reducing NO<sub>x</sub> from various stationary sources.

One of the main sources of NO<sub>x</sub> emissions at March AFB is the diesel engines powering AGE units. These are four- and two-stroke diesel engines in the power range of 50 to 150 hp. Currently, these units are not in compliance with the SCAQMD rules. The EPA/NESHAP regulations for the California Federal Implementation Plans (FIPs) require NO<sub>x</sub> emission standard for non-road engines not to exceed 4 gr/bhp.hr. Many Air Force and DOD facilities are affected by FIPs.

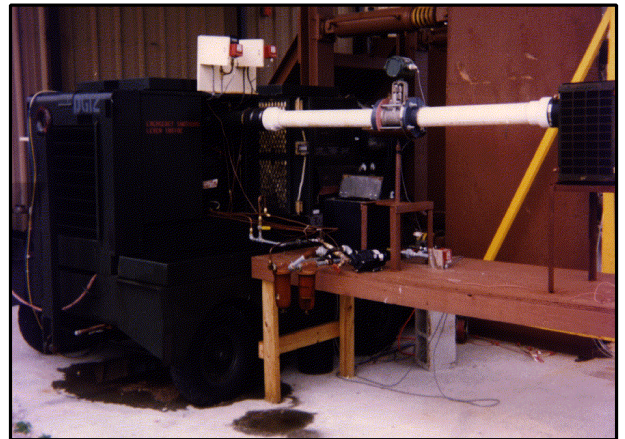
## THE SOLUTION:

To bring the AGE units in compliance with stringent air emissions standards, AFRL/MLQC successfully completed a 12-month proof-of-concept effort using water-diesel emulsion technology. This technology (demonstrated for the AM32-86A two-stroke diesel engine)

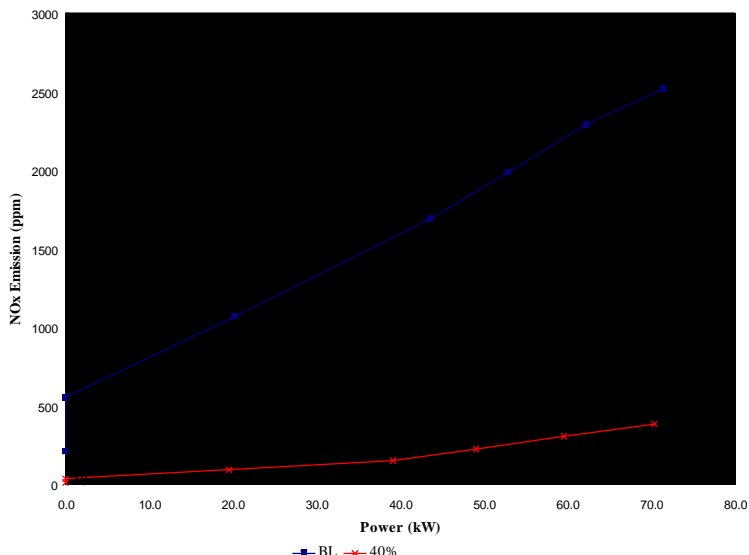
achieved 84.7 percent reduction in NO<sub>x</sub> emission at full-load, 90.6 percent at half-load, and 93.8 percent at idle speed.

## PRODUCT OF RESEARCH:

The success of this technology depended on the development of an additive package to obtain a stable water-diesel/JP-8 emulsion that has: 1) micelle structure of 3 microns average size; 2) improved corrosion resistance; 3) improved thermal stability; and 4) improved lubricity. The additive package includes a surfactant, a corrosion inhibitor, a lubricity enhancer, and a thermal stabilizer. The surfactant is slightly basic (pH 8), biodegradable, nontoxic, and completely soluble in water. A small amount (one percent by volume) of the additive package produces a stable emulsion with long shelf-life stability using minimum mechanical agitation. It is cost-effective, simple to mix, and can use the same base fuel for a particular engine.



AM32-86A AGE Generator During Testing



**NO<sub>x</sub> Emission Of AM32A-86 Engines. Using N-90 Injectors and 40 percent water in emulsion. Upper curve is baseline data.**

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